

ELEX 3525 FINAL EXAM

2014 30

Q.1

$\begin{matrix} & 0 & 4 & 1 & 3 \\ = & 0000 & 0100 & 0001 & 0011 \\ & & yy & yy & xx \end{matrix}$

using the UTF-8 encoding table.

00000yyy yyxxxxxx	110yyyyy	10xxxxxx
zzzzzzzz zzzzzzzz	1110zzzz	10zzzzzz

(2 bytes)

$\Rightarrow \underline{110} 10000 \quad \underline{10} 010011$

$= 11010000 \quad 10010011$

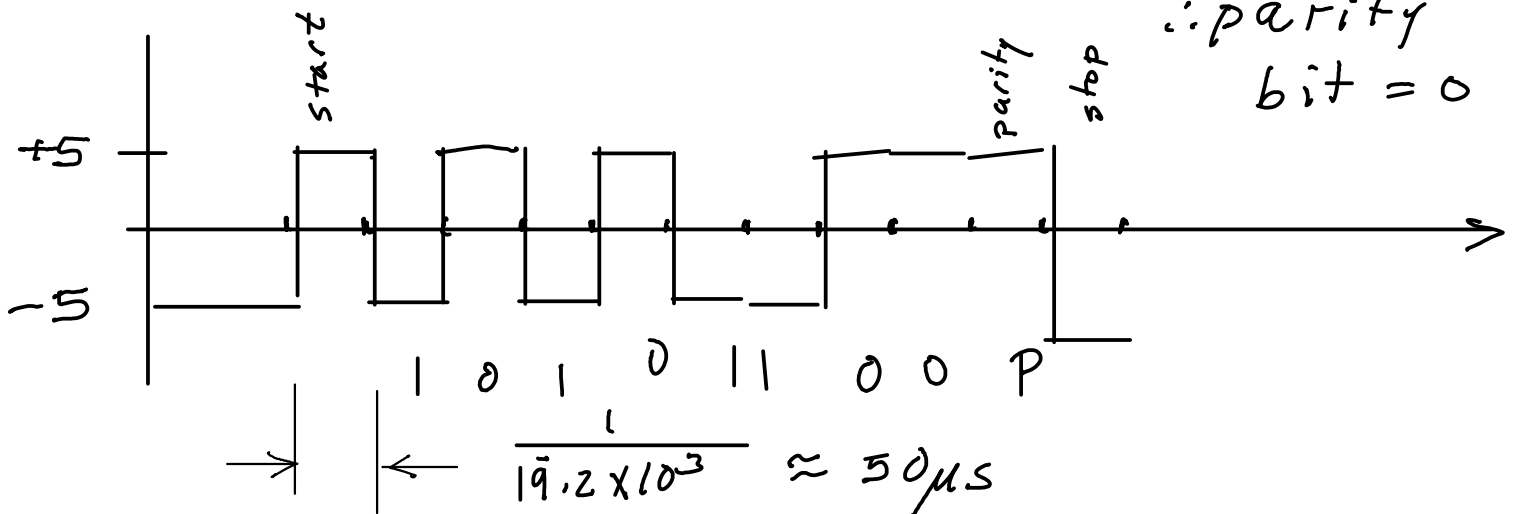
$= \underline{0xD0}, \underline{0x93}$

Q.2 $0x35 = 00110101$

in order from LS to MS bit:

1010 1100

4 ones
= even parity,
 \therefore parity
bit = 0



$$\underline{Q.3} \quad \epsilon_r = 1 \quad v_F = \frac{1}{\sqrt{\epsilon_r}} = 1$$

$$v = v_F \cdot c = 1 \cdot 3 \times 10^8 \text{ m/s} = 3 \times 10^8 \text{ m/s}$$

$$v = \frac{1}{\sqrt{LC}}$$

$$L = \frac{1}{C v^2} = \frac{1}{100 \times 10^{-12} \times (3 \times 10^8)^2}$$

$$\approx 10^{-7} = 0.1 \mu\text{H/m}$$

$$Z_0 = \sqrt{\frac{L}{C}} = \sqrt{\frac{10^{-7}}{10^{-10}}} = \sqrt{1000} \approx 32 \Omega$$

$$\underline{Q.4} \quad C = B \log_2 \left(1 + \frac{S}{N} \right)$$

$$\frac{S}{N} = -40 \text{ dB} = 10^{-4}$$

$$C = 1 \times 10^6 \log_2 (1 + 10^{-4})$$

$$\approx 144 \text{ bps}$$

Q.5 to ensure N or fewer consecutive 0's,
insert (and remove) a '1' after N
zero bits:

N = 3:

0	1	2	3		1	0
1	0	0	0	1	0	1

inserted stuff bit

original sequence:

100001

$N=4$:

0	1	2	3	0	1	0
1	0	0	0	1	0	1

no stuffed bits, original sequence is:

1000101

Q.6: $x^2 + x = 1x^2 + 1x^1 + 0x^0$
 $\Rightarrow 110$ (3 bits)

\therefore CRC has 2 bits

find remainder:

$$\begin{array}{r}
 1110 \\
 110 \overline{) 100100} \\
 \underline{110} \\
 001 \\
 110 \\
 \underline{001} \\
 000 \\
 110 \\
 \underline{000} \\
 000 \\
 000 \\
 \underline{000} \\
 00
 \end{array}
 \rightarrow \text{CRC is } \boxed{00}$$

(check is same as original calculation.)

Q. 7

(a) NRZ transmits 1 bit/symbol

$$\therefore \text{bit rate} = \frac{1}{1 \mu s} = 1 \text{ Mb/s}$$

only $\frac{1}{2}$ are data bits due to rate- $\frac{1}{2}$ code & only $\frac{1}{2}$ of frames are correctly received \therefore

$$\text{throughput} = 1 \times 10^6 \cdot \frac{1}{2} \cdot \frac{1}{2} = 250 \text{ kb/s}$$

(b) for lowest cost, stop and wait is best & no performance penalty if delay is short.

$$\begin{array}{r} \text{(c)} \quad \begin{array}{cccccc} & 0 & 0 & 1 & 0 & 0 & 1 \\ \oplus & 1 & 1 & 1 & 0 & 0 & 0 \end{array} \\ \hline \end{array}$$

$110001 \rightarrow 3 \text{ bits differ}$

\therefore Hamming distance is 3.

(d) Ethernet address assigned by manufacturer \therefore NO

IP address assigned based on network address \therefore YES

(e) NEXT is caused to receiver at transmit end but the system is transmit-only \therefore no NEXT is caused. with multiple pairs, crosstalk could affect remote receiver, \therefore only FEXT is possible.

(f) for Manchester the minimum time between transitions is half ($\frac{1}{2}$) the bit duration. \therefore the baud rate is twice (2) the bit rate.